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# Thrips (Thysanoptera) Chapter 13.1

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## Abstract

Thrips (Order Thysanoptera) are found worldwide and include almost 6000 species. Several of them are notorious for causing extensive crop damage (by feeding on leaf tissue or by vectoring viral disease). Their small size (usually less than 2 millimeters) and cryptic habits have facilited invasions and establishment in Europe in the wild or in greenhouses. Fifty-two alien species, belonging to four families have been recorded within Europe. Species introduced before 1950 mostly originate from America, tropical and subtropical areas and subsequent arrivals generally originate from Asia (and from America to some extent). Five countries host more than 30% of the European alien thrips fauna and two alien thrips occur in more than 50% of the countries and islands of Europe.

## Keywords

Thysanoptera, thrips, alien, Europe

## 13.1.1. Introduction

Thrips (Order Thysanoptera) are ubiquitous, small to minute (a few millimeters long) and slender-bodied insects with fringed wings. The morphology is reduced: thrips have only one functional mandibular stylet, the second being greatly reduced, thus forming asymmetrical suctorial mouthparts compacted within a short cone-shaped rostrum. About 50% of the known species of Thysanoptera feed on fungi, approximately 40% feed on living tissues of dicotyledonous plants or grasses, and the remainder exploit

mosses, ferns, gymnosperms, cycads, or are predatory (Morse and Hoddle 2006). Less than 1% of described thrips species are serious pests and most economic literature deals with just four species (Mound and Teulon 1995).

The almost 6000 known species of thrips are at present arranged into two suborders (Terebrantia and Tubulifera) and nine families, but disagreement exists concerning the family classification system (Mound 2007). Phlaeothripidae is the largest family and the sole family in the suborder Tubulifera with about 3500 described species (Mound and Morris 2007). The other eight families are all included in the suborder Terebrantia (2400 species). Members of the Merothripidae (15 species) and Uzelothripidae (1 species) are all very small thrips associated with fungal hyphae in warm countries. In contrast, members of the Melanthripidae (65 species) are usually large and robust, and they all breed in flowers, and occur in temperate areas. The Aeolothripidae (190 species) is a rather larger family of mainly phytophagous species feeding on flowers, or non-obligate predators of other arthropods. The species of the next three families are poorly known, Fauriellidae (5 species) from California, southern Europe and South Africa. Adiheterothripidae (6 species) are known only from the flowers of date palms, *Phoenix dactylifera* and Heterothripidae (71 species), are found only in the New World and, with one exception, all species live within flowers. The eighth family, with nearly 2100 known species is by far the largest within Terebrantia : Thripidae are found worldwide and include almost all of the pest species of thrips, many of them feed and breed on both leaves and in flowers.

### 13.1.2 Taxonomy of the Thysanoptera species alien *to* Europe

The 52 species of Thysanoptera alien *to* Europe belong to four different families (Table 13-1) but two of them (Phlaeothripidae and Thripidae) include more than 99% of the alien species.

#### Suborder Tubulifera

***Phlaeothripidae***: The traditional classification of Tubulifera comprises a single family with two subfamilies. All members of the smaller subfamily, the Idolothripinae, feed on fungal spores and live on dead twigs, in leaf litter or within the bases of grass and sedge tussocks. The spore-feeding *Nesothrips propinquus* is the unique alien species among less than 30 european species and is widely distributed in countries occuring along the sailing route from New Zealand to Europe, presumably in hay and straw (Mound 2006). It can be found on citrus fruits in its native habitat but there is no evidence of producing any damage (Blank and Gill 1997). Phlaeothripinae is the main subfamily of Phlaeothripidae, with 2800 species (Mound and Morris 2007). They exhibit a wide range of biologies: a few are predatory, some are flower feeders but in most cases, they are leaf feeding or associated with fungi in leaf litter or on dead wood. Fourteen species

belonging to ten genera are here considered to be alien species in Europe (from a total of around 180 native species). Among them, five species prey upon small arthropods (including scale insects), five species are detrivorous and four species are known to be phytophagous, including *Gynaikothrips ficorum* which is recognized as a pest on *Ficus* (preferred host) and other hosts.

## Suborder Terebrantia

***Merothripidae***: This family of three genera, with 15 fungus-feeding species that live on dead twigs and in leaf-duff, is found mainly in the Neotropics (Hoddle et al. 2004). *Merothrips floridensis* is the unique representant of this family in Europe. This is an interesting example of a small and usually wingless species with a scattered distribution, probably associated with trading routes and commercial traffic of hay, dead wood and living plants (Mound 1983).

***Aeolothripidae:*** Until recently, Melanthripidae was included in this family. However, a morphology-based distinction with the Aeolothripidae is now well supported (Mound and Morris 2007). Typical Aeolothripidae are generally regarded as facultative predators on other small arthropods but with a few exceptions. They are mainly distributed in the temperate parts of the world, although members of several genera are restricted to the tropics. This is the case of the two alien species of ant-mimicking thrips (*Franklinothrips vespiformis* and *Franklinothrips megalops*) recorded in Europe, that have been marketed or tested as biocontrol agents in glasshouses (Mound and Reynaud 2005).

***Thripidae***: Four sub-families are currently recognized worldwide. Each of these is represented by alien species in Europe. Dendrothripinae are small in size and live on young leaves. They have been defined by the presence of a remarkably elongate metasternal endofurca associated with a jumping habit. There are two alien species, *Leucothrips nigripennis* and *Pseudodendrothrips mori*, compared to eight native species. Panchaetothripinae are strongly reticulate thrips and are regarded as leaf feeders with a tropical or subtropical distribution. They are well represented amongst alien species (eight species) because they are able to breed on ornemental plants in European greenhouses. There are no native species in Europe with one exception in the canary Islands and Madeira. Sericothripinae are a small sub-family in Europe with only two genera and eight species, including one recently described alien (*Neohydatothrips samayunkur*). The species are all phytophagous in flowers and on leaves. The subfamily Thripinae is the main sub-family in Europe with 59 genus and more than 240 native species and the main group of aliens in Thysanoptera with 18 genera and 24 species. Thripinae feed and breed both on leaves and in flowers and a few are specialized predators. Some thrips species transmit plant viruses. They are all included in this subfamily. Thrips-transmitted viruses can cause significant diseases of many crop plants and their impact worldwide is immense. In Europe, seven thrips species are known vectors of

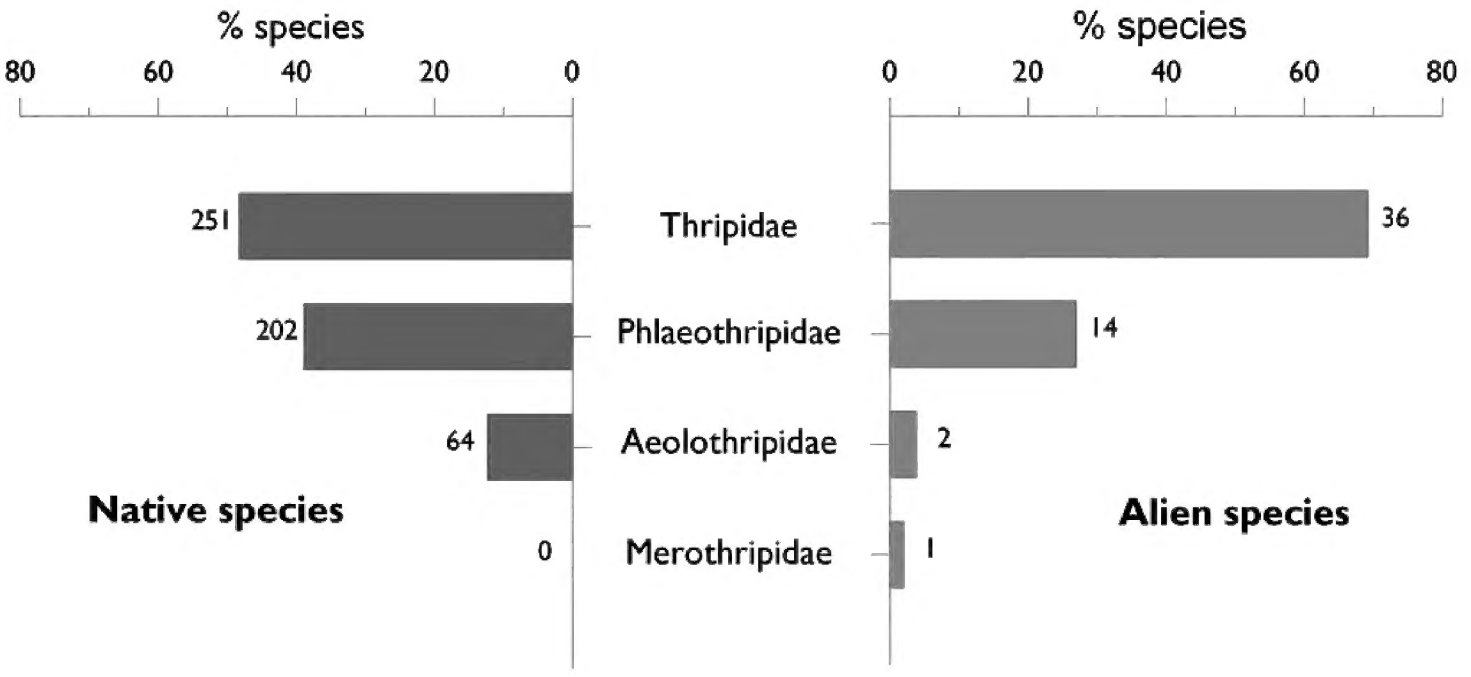


**Figure 13.1.1.** Relative importance of the families of Thysanoptera in the alien and native entomofauna in Europe. Families are presented in a decreasing order based on the number of alien species. Species alien *to* Europe include cryptogenic species. The number over each bar indicates the number of species observed per family.

virus including five alien species: three species of *Frankliniella*, one species of *Thrips* and *Microcephalothrips abdominalis* (Jones 2005). Western flower thrips, *Frankliniella occidentalis* is one of the most important pests of greenhouse crops, especially in ornamental species.

### 13.1.3 Temporal trends of introduction in Europe of alien thrips

Because of their small size, ability to reach high numbers, cryptic behavior, egg deposition inside plant tissue (e.g., all Terebrantia), and a propensity to secrete themselves in tight spaces (Morse and Hoddle 2006), thrips remain inconspicuous insects. The accurate recognition of alien Thysanoptera species is also a major challenge because of the difficulty of a morphometric identification (close morphological similarity) for non-specialists. There is also a lack of taxon specialists that are needed to study newly recorded species, confounded by the lack of identification keys in local monographs. Thrips identification requires significant experience, encyclopaedic knowledge, a good reference collection and relevant literature. Molecular and visual online-identification tools of the main pest thrips are now available but are not yet widely used.

For the reason above, it is likely that the real number of of alien thrips species present in Europe is greatly underestimated. The date of the first record in Europe is also unknown for seven species (13.5%). The first alien thrips species (*Heliothrips haemorrhoidalis*, called the greenhouse thrips) was discovered and originally described by Bouché in Germany in the first half of the 19$^{th}$ century from specimens taken from a greenhouse. This species was probably introduced into Europe on ornamental plants from tropical America. *H. haemorrhoidalis* is now widespread in Europe indoors and

can be found outdoors in the southern countries. Before the First World War, seven different tropical thrips were recorded as minor pests or useful predators, always collected under protected conditions. The first outdoor alien species collected in Europe was the Thripinae *Stenchaetothrips biformis*, a major pest of rice in Asia, described in England and collected later in several european countries. *S. biformis sensu stricto* is common in vegetative shoots of *Phragmites australis* in temperate Europe, even though *S. biformis* 'rice form' is common on *Oryza sativa* in Asia and South America (Vierbergen 2004).

From 1950, a clear acceleration of thrips introductions is evident (Figure 13.1.2), with a new alien species every two years on average and as many as one new alien species per year during the period 1975 - 1999. The main event during this period was the occurrence of the western flower thrips *Frankliniella occidentalis* in the Netherlands in 1983, originating from western North America. By 1986, it was reported in Sweden and Denmark and, by 1987, it had reached France and Spain. Since then, it has been reported from most European countries and has become a major pest of agricultural and horticultural crops throughout. Since 2000, three non-native Thysanoptera are recorded, with a somewhat smaller rate of discovery compared with the previous period.

## 13.1.4. Biogeographic patterns of the thrips species alien to Europe

### *13.1.4.1 Origin of alien species*

Exact knowledge of the geographical origin of alien thrips species is a vital step in enforcement of scientifically based plant quarantine and free trade protocols. Unfortunately, the area of origin of alien thrips remains unclear in 13.5% of cases. Many alien species were first described in Europe, but were undoubtedly native from other continents. Kelly's citrus thrips (KCT) was thus first collected in October 1914 in Queensland (Australia), described as *Physothrips kellyanus* by Bagnall in 1936 and known only from Australia in the last 36 years. After taxonomic studies, KCT was transferred to *Pezothrips*, a new genus including nine Palaearctic species. The morphological similarity of KCT to the eight *Pezothrips* species from the southern Palaearctic suggests that *P. kellyanus* itself originated in that part of the world. But KCT is not known to breed on any endemic plant in Mediterranean countries even when KCT larvae and adults have been found on australian endemic plants such as *Myoporum insulare* (Myoporaceae) (Webster et al. 2006). KCT is a good example of a thrips species with an unclear origin. The spread may have had more than one origin and the source of reintroductions of many plant pests and pathogens has changed over time. For example, *Frankliniella occidentalis* originally from the USA, was introduced to the UK from the Netherlands, and is reintroduced from several tertiary sources, such as Kenya (Perrings et al. 2005).

Alien thrips come mainly (65.4%) from Asia, Central and South America and North America (Figure 13.1.3). Temporal analysis shows that Central and South America and Africa were the main source of introductions before 1900, followed by species

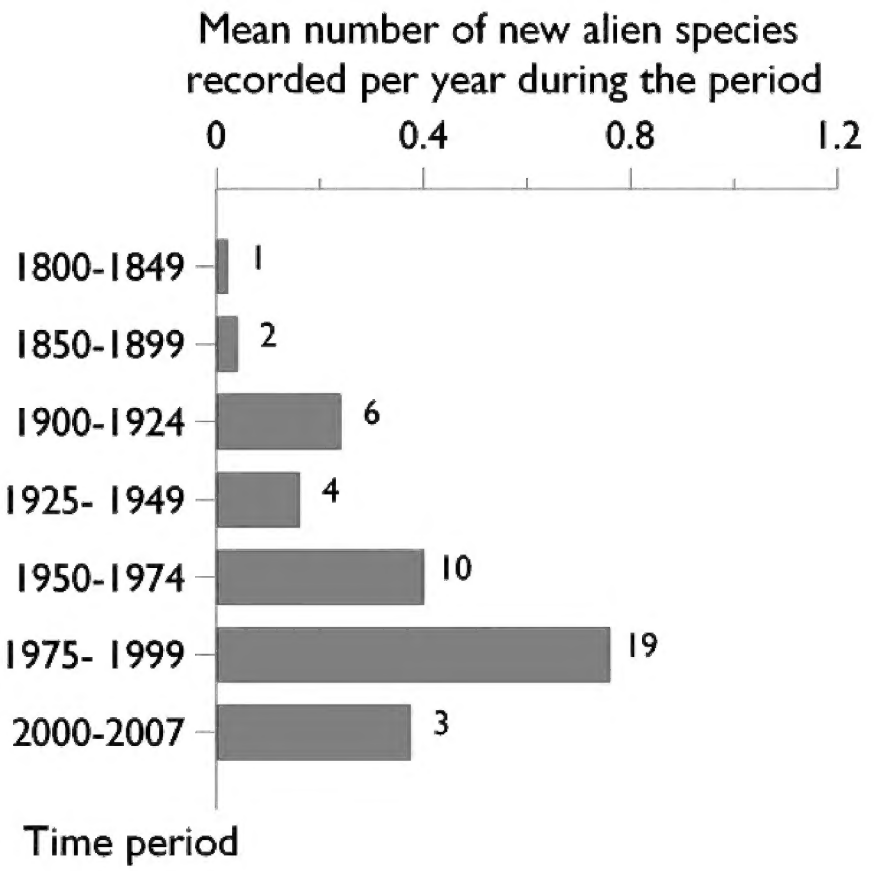


**Figure 13.1.2.** Temporal changes in the mean number of records per year of Thysanoptera species alien *to* Europe from 1492 to 2007. The number over each bar indicates the absolute number of species newly recorded per time period.

of mainly tropical, subtropical and Australasian origins between 1900 and 1950. After that date, non-indigenous thrips mostly originate from Asian and secondarily from North America.

### *13.1.4.2 Distribution of alien species in Europe*

Figure 13.1.4 presents the colonization of European countries and main islands by alien thrips. Countries can be divided into the following categories:

- 13 countries with no known alien species. They include particulary small countries, some small southern islands, northern islands and a large northern country, Belarus.
- 21 countries which host less than 10% of the known invasive thrips in Europe. This category comprises large countries, probably poorly sampled by entomologists (Greece) or northern countries (Poland, Ukraine, Austria) and large islands which have been poorly surveyed.
- 17 countries with 10% to 30% of the known invasive thrips. This group generally consist of large countries (Germany, Spain, Sweden, Norway, Finland) but also includes small southern islands (Azores, Madeira, Canary islands) well sampled by entomologists and with a favourable climate for exotic thrips.
- 5 countries with more than 30% of the known European alien thrips fauna. Three large countries are involved, two with varied but favourable climate (Italy and France) and two with a long tradition of thysanopterologists (Great Britain and

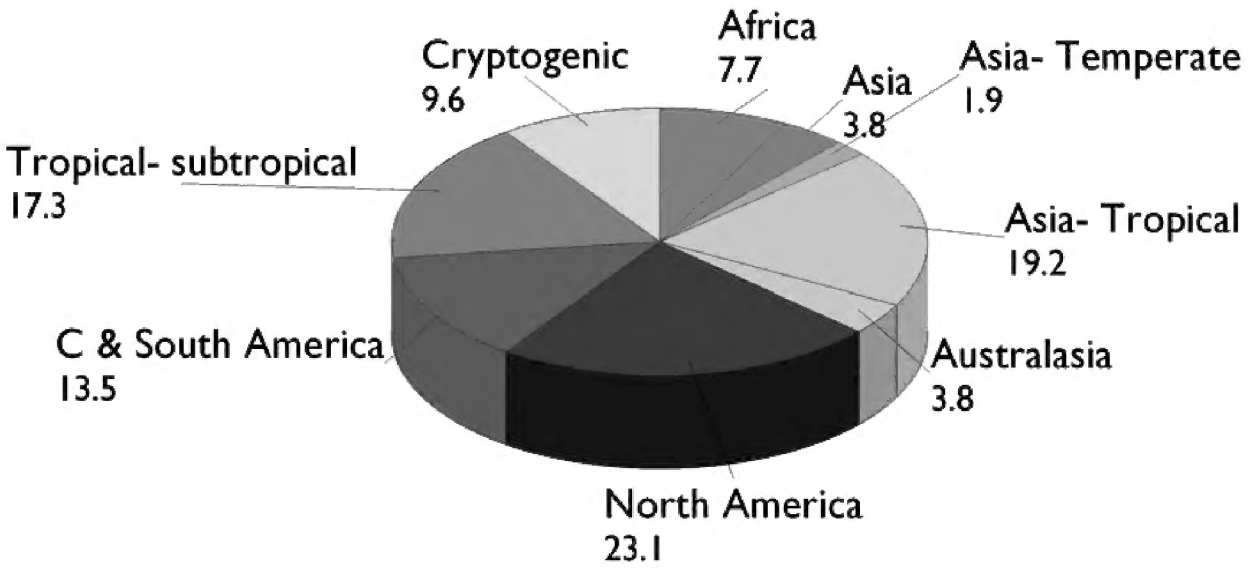


**Figure 13.1.3.** Origin of the 52 alien species of Thysanoptera established in Europe. Numbers indicate the relative proportion of alien species originating from a given region.

Germany). Lastly, Netherlands, owing to its open economy and international trade, records 20 alien thrips species.

Surprisingly, there is no significant relationship between country surface area and number of alien species (Figure 13.1.5, $r^2 = 0.2522$). For instance, Netherlands and Italy harbour the same number of non-native thrips, but Netherland surface is only 14% of of the area of Italy.

Only two alien thrips (*Frankliniella occidentalis* and *Heliothrips haemorrhoidalis*) occur in more than 50% of the countries and islands of Europe and a quarter of the species are known from a single country. There is no clear relationship between the date of first record and the number of contaminated countries.

## 13.1.5. Pathways of introduction in Europe of alien thrips species

Adults and larvae of Thysanoptera are very small, highly thigmotactic, and often lay minute eggs within plant material (e.g. petioles, stems, leaves and fruit) making rapid visual detection impossible. As a consequence, accidental introduction in Europe is the rule for non-native Thysanoptera (94%) and intentional introduction is confirmed for only three species (*Franklinothrips vespiformis*, *Franklinothrips megalops* and *Karnyothrips melaleucus*). The global trade in ornamental greenhouse plants is clearly the main pathway for non-native thrips: all widespread alien species in Europe are greenhouse pests or predators. It also means that after introduction, domestic trade of ornamental plants inside Europe is a major pathway for the transport of thrips. Greenhouse environments eliminate climatic barriers to establishment (e.g., *H. haemorrhoidalis*) and may also provide important overwintering sites from which outdoor populations establish in spring to attack vegetable crops (e.g., *F. occidentalis* in northern Europe) (Morse and Hoddle 2006).

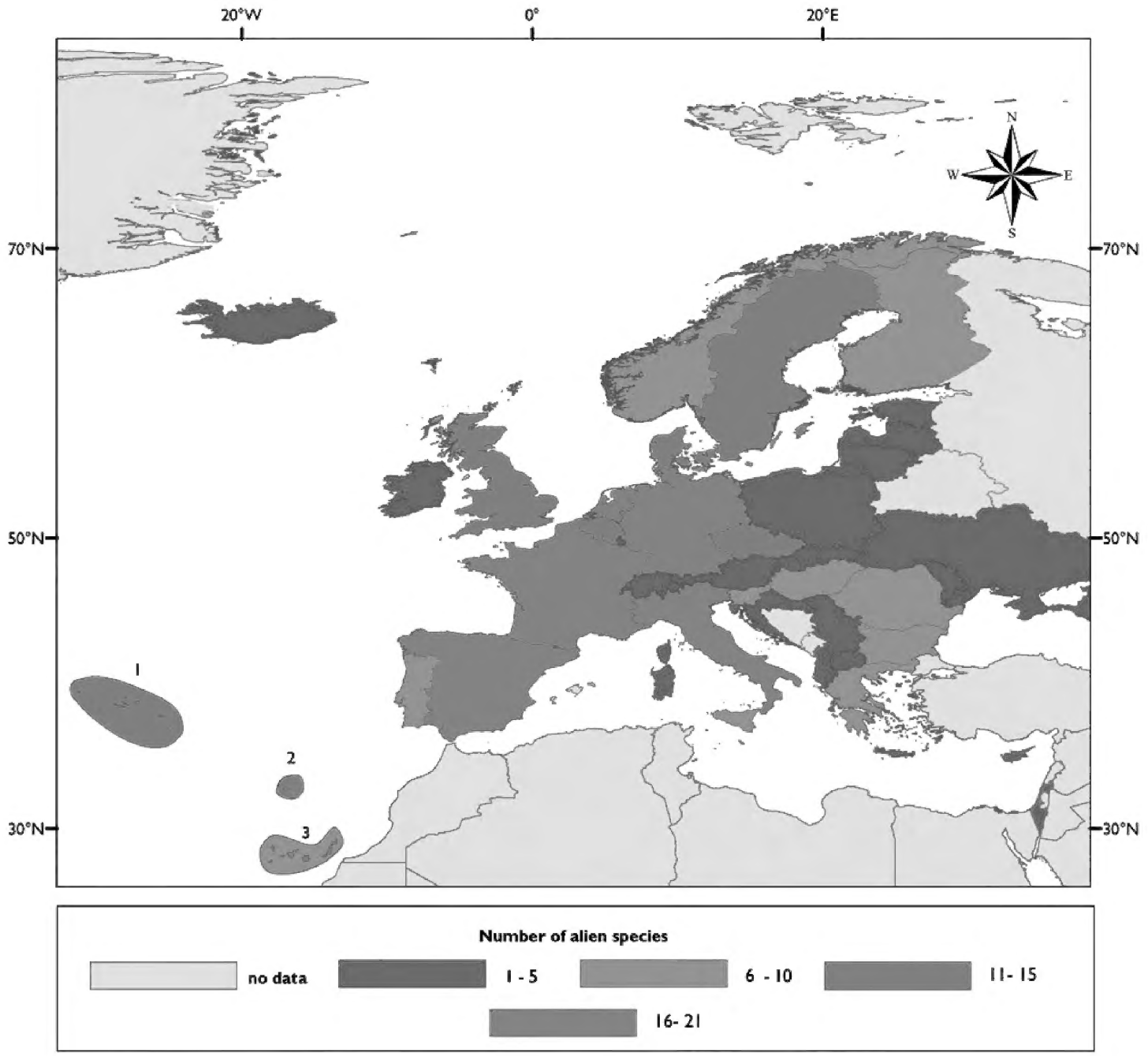


**Figure 13.1.4.** Comparative colonization of continental European countries and islands by the thrips species alien *to* Europe. Archipelago: **1** Azores **2** Madeira **3** Canary islands.

## 13.1.6. Ecosystems and habitats invaded in Europe by alien thrips species

Although thrips are known as inhabitants of flowers, they are also abundant and diverse in other microhabitats. They are phytophagous insects, sap suckers (some of which feed on aquatic plants), but can also work as decomposers, fungivores, pollinators, predators on insects and mites, whilst one species was recently discovered as an ectoparasite under the wings of a bug.

Alien thrips are mostly phytophagous (75%) and seldom predators (13.5%) or detritivores (11.5%). Cultivated habitats are preferentially (94.2%) invaded by exotic thrips, including greenhouses that provide suitable habitat for 55.8% of the invasive species in Europe (Figure 13.1.5).

Nevertheless, we can assume that thrips species such as spore and fungal feeders are underestimated in faunal studies, because these ecosystems are usually less investigated by thysanopterologists. Similarly, the wild flora that surrounds areas of crops is rarely

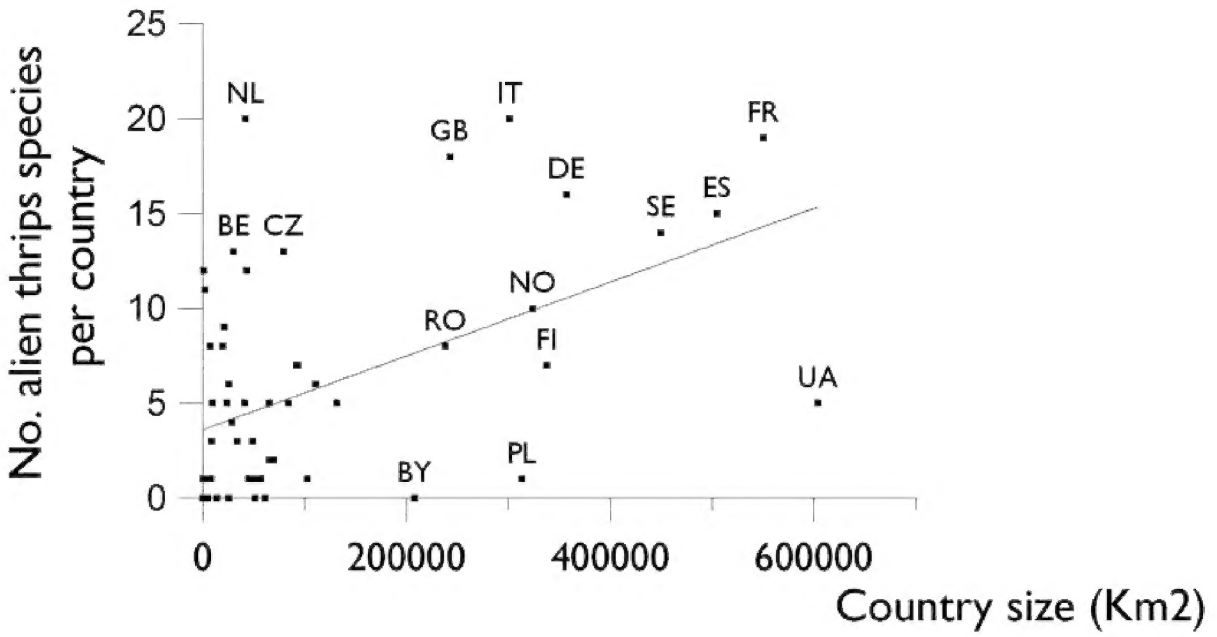


**Figure 13.1.5.** Relationships bewteen the size of the European countries and the number of alien Thysanoptera observed in the country. best fit: Y= 2E-05x + 3.5957; r= 0.2522)

sampled. It may also be important in facilitating the spread and colonization of new ecosystems. The remaining habitats (13.5%) include deciduous wooded habitats, dry grasslands or unknown habitats.

## 13.1.7. Ecological and economic impact of alien thrips species

Three major food sources are used by thrips: fungal hyphae and spores, green leaves, and flowers with or without leaves as well. A few species are also predators, and a very few feed only on mosses (Mound and Marullo 1996). More than 95% of Terebrantia are associated with vascular plants, whereas about 60% of Tubulifera species are fungivores (Mound 2002). But of an estimated 8000 extant species of thrips (Lewis 1997) and more than 5500 species that are described, scarcely 1% are recorded as serious pests, mainly in the Thripidae family.

Thrips can affect plants by direct feeding, which may leave visible signs of damage, such as leaf silvering. Many tubuliferans also cause galls[1]. A few thrips transmit plant viruses and can cause significant diseases of many crop plants and their impact worldwide has been judged to be substantial (Jones 2005). Thrips can also be considered as pests through their habit of crawling into small spaces, a behavior known as thigmotaxis. This behaviour can trigger smoke detectors and fire alarms and thus cause considerable inconvenience. Similarly, thrips can invade computers, watches, paintings, polystyrene building insulation, hypodermic needles in manufacture, and many other unlikely places (Hoddle et al. 2008). Thrips may also become a nuisance when they swarm and land on exposed areas of skin but humans

[1] Not all plant feeding by thrips is disadvantageous: attempts have been made in USA to control alligator weed (*Alternanthera philoxeroides*) by *Amynothrips andersoni* imported from Argentina.

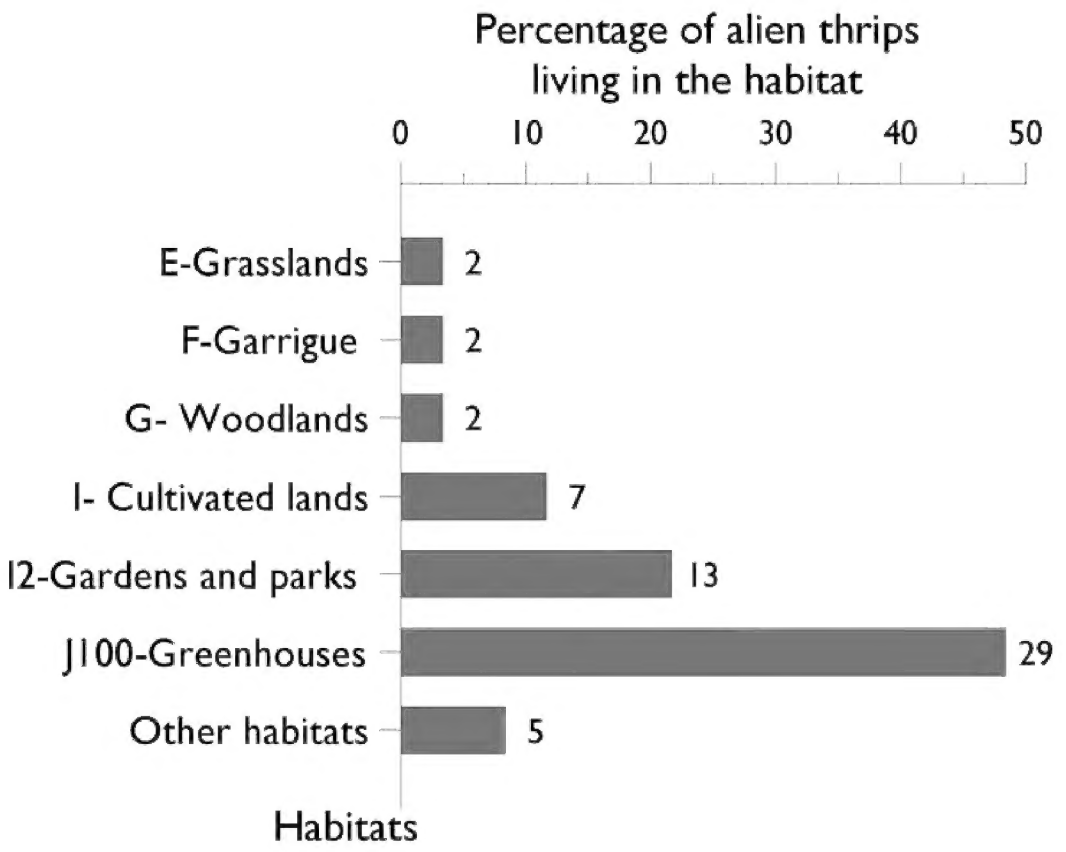


**Figure 13.1.6.** Main European habitats colonized by the established alien species of Thysanoptera. The number over each bar indicates the absolute number of alien thrips recorded per habitat. Note that a species may have colonized several habitats.

are usually unintended, occasional, short-term hosts without medical consequences (Faulde et al. 2007).

Throughout the world, only six of the 210 described species of *Frankliniella* are known to be vectors of viruses, only four of the 290 species of the genus *Thrips*, and just one of the 100 species of *Scirtothrips*. In addition, one species of *Ceratothripoides* and *Microcephalothrips abdominalis* are known to transmit virus. Thrips transmit plant viruses in the *Tospovirus, Ilarvirus, Carmovirus, Sobemovirus* and *Machlomovirus* genera (Jones 2005).

Of over 52 species of alien thrips, less than 10 can be considered as having an impact on human activities. The ecology and biology of other species is generally poorly known and ecological and economic impact cannot be evaluated. Various members of the genus *Franklinothrips* are of economic importance (Mound and Reynaud 2005). *F. vespiformis* is recently marketed in continental Europe and Israel as a biocontrol agents in greenhouses for the control of thrips and mite pests; its prey also includes whiteflies and leafminers (Larentzaki et al. 2007).

*Frankliniella occidentalis* (the Western flower thrips) is a major worldwide crop pest with a huge economic impact and has become a key pest in a large range of agricultural and floricultural production areas in the world (see factsheet 14.78). It has a very extensive host range including field crops, orchards, greenhouse crops and weeds. The Western flower thrips is considered as the most important thrips vector of diseases. It transmits *Chrysanthemum stem necrosis virus* (CSNV), *Groundnut ringspot virus* (GRSV), *Impatiens necrotic spot virus* (INSV), *Tomato chlorotic spot virus* (TCSV) and *Tomato*

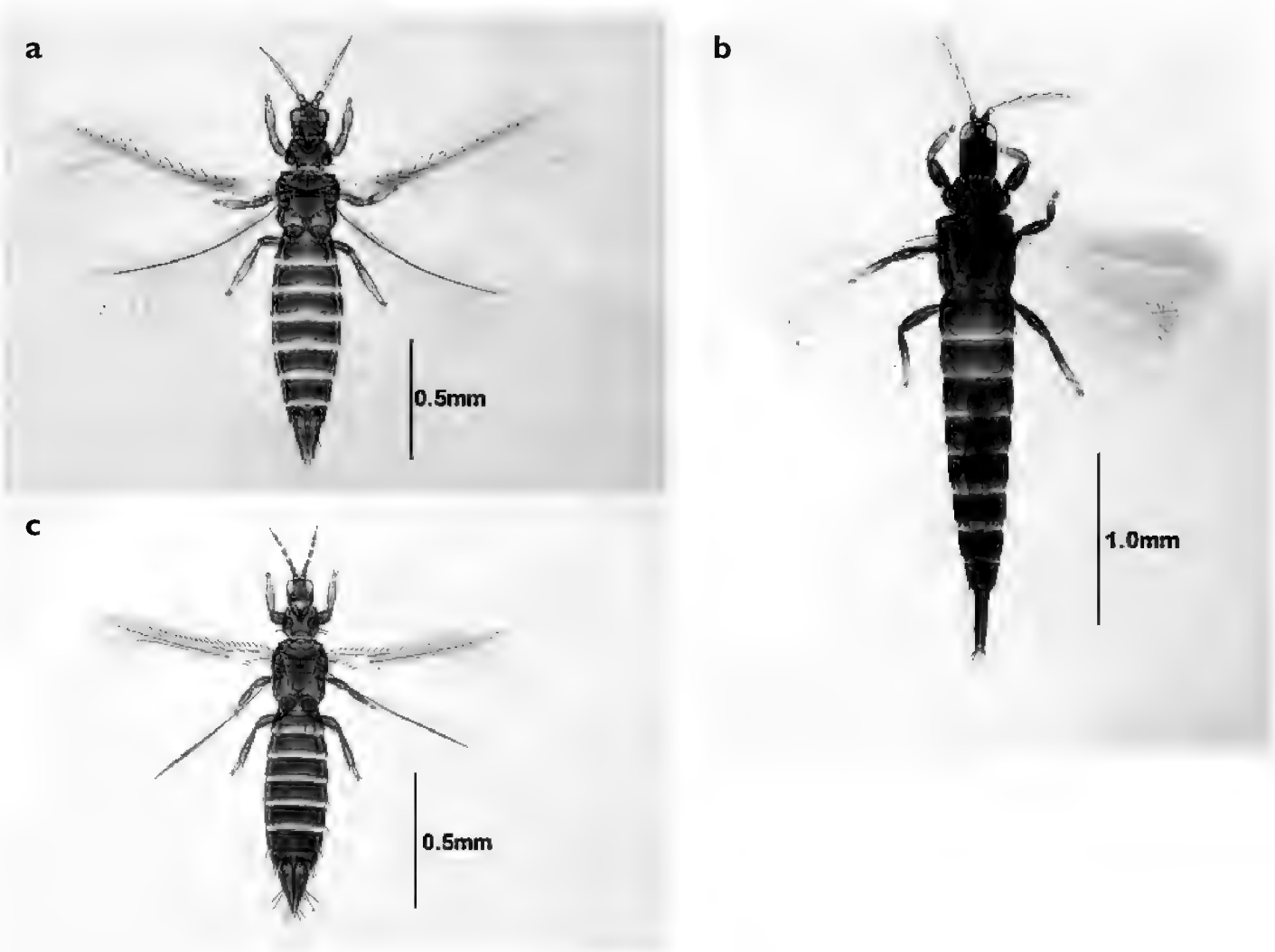


**Figure 13.1.7.** Adults of some Thysanoptera alien *to* Europe. **a** *Echinothrips americanus* **b** *Gynaikothrips ficorum* **c** *Pezothrips kellyanus* (credit: Philippe Reynaud, LNPV).

*spotted wilt virus* (TSWV). There is also an indirect economic effect when introduced into a new area. For example, western flower thrips is a major economic driving force of greenhouse and field crop IPM research. *F. occidentalis* is restricted to glasshouses in northern Europe, but has established outdoors in areas with milder winters. The international spread of the western flower thrips occurred predominantly by the movement of horticultural material, such as cuttings, seedlings and potted plants. Within Europe, an outward spread from the original outbreak in the Netherlands (1983) is discernible. The speed of spread was 229 +/- 20 km/year (Kirk and Terry 2003). Chemical control is difficult, because *F. occidentalis* is resistant to most pesticides, but some predatory mites and minute Pirate bugs provide effective biological control under glasshouses. Two other North American *Frankliniella* species are known in Europe, but with a very limited distribution and without economic impact. The potential introduction of the Melon thrips (*Thrips palmi*) represents a continuous threat to glasshouse ornamental and vegetable crops in Europe (see factsheet 14.80). Numerous interceptions have been reported on cut flowers and fruit vegetables and several outbreaks were found in glasshouses in the Netherlands and UK since 1988. The potential of adults and larvae to survive an entire winter oudoors in the UK is very limited however (McDonald et al. 2000), which has favoured successful control and eradication of all these outbreaks. *T. palmi* is considered to be absent in Europe, although it was detected outdoors within flowers of kiwi fruit (*Actinidia deliciosa*) in Portugal in 2004, but in later surveys the

pest was no longer found. The palm thrips is essentially a tropical species, and therefore most parts of Europe are not suitable for its establishment. We can assume, however, that most of southern Europe could harbour this species outdoors and the species could establish indoors in other places. High developmental and reproductive rates at glasshouse temperatures allows rapid build-up of populations, even from small numbers of females (Cannon et al. 2007). Vector of alien topospovirus, the Melon thrips has been implicated in the transmission of at least six plant viruses. *T. palmi* is a quarantine organism for the EU and as such requires eradication wherever it is found.

Several other alien thrips species occur indoor in Europe with a low economic impact, including *Hercinothrips femoralis*, *Heliothrips haemorrhoidalis* and *Echinothrips americanus*. These species are found in the wild in tropical and subtropical regions, but are restricted to glasshouses in western Europe, with the exception of *H. haemorrhoidalis* (also called the greenhouse thrips). The greenhouse thrips can also live in the wild in southern Europe. It has many hosts, including ornamental shrubs and field crops (citrus, avocado and tea) but preferred hosts in Southern Europe are *Myrtus communis* and *Viburnum tinus*. *E. americanus* was recently introduced from the USA, where it is seldom a pest, into Europe (Netherlands). However, in Europe it has more than 50 known food plants, including ornamental and woody plants and vegetables. The species is often found in sizable numbers without showing obvious damage symptoms to the plant (Vierbergen et al. 2006) and seems to be highly susceptible to insecticides (Karadjova and Krumov 2003). *H. femoralis* (the sugar beet thrips) is a minor polyphagous pest under glasshouses that feeds on more than 50 hostplants but is also an important pest almost everywhere where bananas are grown (Trdan et al. 2007).

The genus *Gynaikothrips* includes about 40 species, with two related pest species (*G. ficorum* and *G. uzeli*). The same common name (Cuban Laurel Thrips) is used for these two leaf-galling thrips species on decorative *Ficus* trees distributed worldwide by the horticultural trade. But only *Gynaikothrips ficorum* is at the present time known as an alien species in Europe. These two species can only be differenciated by a microscopic examination of the pronotal posteroangular pair of setae. According to Mound et al. (Mound et al. 1995), *G. ficorum* is the primary gall maker on *Ficus microcarpa* while *G. uzeli* is the primary gall maker on *F. benjamina*. *G. ficorum* was first described from Algeria, but is native of Southeast Asia. Adults vary from about 2.6 mm to 3.6 mm in length and are dark yellowish-brown to black. Infested, curled leaves become hard and tough, then gradually yellower and browner and eventually drop from the plant prematurely. Finally, the ornamental value of the plant is reduced. The Cuban Laurel Thrips is a minor pest in Europe and only under glasshouses, but adults can be a nuisance in North Africa on *Ficus microcarpa* planted in cities, by flying into people's eyes or irritating their skin (Mumcuoglu and Volman 1988).

The Composite thrips *Microcephalothrips abdominalis*, the only species in the genus, is a light-brown species characterized by an unusual small head in relation to the pronotum. It lives on Compositae flowers throughout its life, where it is considered as an important pollinating agent. *M. abdominalis* is known to transmit TSV (Greber et al. 1991), a serious disease of peanut and sunflower in India (Jones 2005) but this virus

is not a quarantine pest for EU. It has been suggested that this pantropical species is native to the New World and has been transported elsewhere by man (Stannard 1968). This species has been known from Italy since 1994 but has subsequently shown a slow rate of spead in Europe. The Composite thrips is considered as a minor pest but is not reported yet as a pest in Europe.

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**Table 13.1.1.** List and main characteristics of the Thysanoptera species alien *to* Europe. Status: A: Alien *to* Europe; C: cryptogenic species. Country codes abbreviations refer to ISO 3166 (see appendix I). Habitat abbreviations refer to EUNIS (see appendix II). Only selected references are given. Last update 03/02/2010.

| **Family**<br>*Species* | **Status** | **Regime** | **Native range** | **1st record in Europe** | **Invaded countries** | **Habitat** | **Hosts** | **References** |
|---|---|---|---|---|---|---|---|---|
| **Aeolothripidae** | | | | | | | | |
| *Franklinothrips megalops* (Trybom, 1912) | A | predator | Africa | Unknown | BG, ES, NL | J100 | Greenhouses thrips and black vine thrips | Zur-Strassen (2003), Mound and Reynaud (2005) |
| *Franklinothrips vespiformis* (Crawford, 1909) | A | predator | C & S America | Unknown | BE, CH, DE, DK, FR, IL, NL, PT-MAD, SE | J100 | *Frankliniella occidentalis* and two- spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae). | Zur-Strassen (2003) |
| **Merothripidae** | | | | | | | | |
| *Merothrips floridensis* Watson, 1927 | A | detrito-vorous | C & S America | 1955, FR | ES, FR, PT-AZO | I | *Citrus* (fungivorous) | Bournier (1960), Zur-Strassen and Borges (2005) |
| **Phlaeothripidae** | | | | | | | | |
| *Aleurodothrips fasciapennis* (Franklin, 1908) | C | predator | Crypto-genic | 1908, BE | BE, DE | J100 | *Aonidella, Crysomphalus* and other scales | Bagnall (1909), Geiter et al. (2002) |
| *Bagnalliella yuccae* (Hinds, 1902) | A | phyto-phagous | North America | 1957, FR | FR, HU, IT, RO, UA | I2 | *Yucca* | Jenser (1989) |
| *Eurythrips tristis* Hood, 1941 | A | unknown | North America | 2005, PT-AZO | PT- AZO | U | Sporophagous | Zur-Strassen and Borges (2005) |
| *Gynaikothrips ficorum* (Marchal, 1908) | A | phyto-phagous | Asia-Tropical | 1983, FR-COR | CZ, DE, FR-COR, GR-CRE, IL, IT, IT- SAR, IT- SIC, NL, PT, PT-MAD | I2, J100 | *Ficus* | Bournier (1983), Pelikán (1991), Laudonia and Viggiani (2005) |
| *Haplothrips gowdeyi* (Franklin, 1908) | A | phyto-phagous | Africa | 1978, GR | CY, ES, ES- CAN, GR, PT-AZO, PT-MAD | I | Solenaceae, Apiaceae | Zur-Strassen (1986b), Zur-Strassen and Borges (2005) |

| **Family**<br>*Species* | **Status** | **Regime** | **Native range** | **1st record in Europe** | **Invaded countries** | **Habitat** | **Hosts** | **References** |
|---|---|---|---|---|---|---|---|---|
| *Haplothrips rivnayi* Priesner, 1936 | A | phyto-phagous | Asia | 2001, ES | ES | I2 | *Crataegus oxyacantha* | Berzosa et al. (2001) |
| *Hoplothrips lichenis* Knechel, 1954 | C | detrito-vorous | Crypto-genic | 1954, RO | CZ, RO | G | *Prunus armeniacum* | Pelikán (1990) |
| *Hoplothrips unicolor* (Vuillet, 1914) | C | detrito-vorous | Crypto-genic | 1939, GB | CZ, GB, NO, SE | X16 | *Polystictus abietinus* fungus on dead pine branches | Kobro and Rafoss (2006), Mound et al. (1976) |
| *Karnyothrips americanus* (Hood, 1912) | A | predator | North America | 1974, ES | ES | X13 | Predator (sparsely wooded land) | Berzosa (1988) |
| *Karnyothrips flavipes* (Jones, 1912) | A | predator | North America | 1919, AL | AL, CY, ES, IT- SAR, PT | I2 | *Fiorinia fioriniae* (scale) on many ornamentals | Priesner (1919), Canale et al. (2003) |
| *Karnyothrips melaleucus* (Bagnall, 1911) | A | predator | C & S America | 1911, DK | DK, ES- CAN, IT, PT-AZO, PT-MAD, | J100 | Coccidae, Diaspididae scales (*Howardia biclavis*) | Bagnall (1911), Mound and Marullo (1994), Zur-Strassen and Borges (2005) |
| *Nesothrips propinquus* (Bagnall, 1916) | A | detrito-vorous | Australasia | 1974, PT-AZO | ES- CAN, NL, PT-AZO, PT-MAD | I | Sporophagous | Mound (1974), Zur-Strassen and Borges (2005) |
| *Podothrips semiflavus* Hood, 1913 | A | parasitic/ predator | North America | 1964, CY | CY | I | *Aspidiella sacchari* (coccid scale) | Priesner (1964b) |
| *Suocerathrips linguis* Mound & Marullo, 1994 | C | detrito-vorous | Crypto-genic | 1994, GB | BE, GB | J100 | *Penicilium* species living on *Sansevieria* surface | Mound and Marullo (1994) |
| **Thripidae** | | | | | | | | |
| *Anaphothrips sudanensis* Trybom, 1911 | A | phyto-phagous | Tropical, sub-tropical | Unknown | ES, CY | E1, F6 | Grasses, cereals | Zur-Strassen (2003) |
| *Anisopilothrips venustulus* (Priesner, 1923) | A | phyto-phagous | C & S America | 1969, P-AZO | IT, PT-AZO, PT-MAD | I | *Cyathula prostrata* (folivorous) and young coconut fruits | Zur-Strassen (1973a), Zur-Strassen and Borges (2005) |

| Family<br>*Species* | Status | Regime | Native range | 1st record in Europe | Invaded countries | Habitat | Hosts | References |
|---|---|---|---|---|---|---|---|---|
| *Aurantothrips orchidaceus* (Bagnall, 1909) | A | phyto-phagous | C & S America | 1907, GB | BE, DE, DK, FR, GB, NO, SE | J100 | Orchidaceae | Bagnall and John (1935), Sakimura (1967) |
| *Bradinothrips musae* Hood, 1956 | A | phyto-phagous | C & S America | 1998, I | IT, SE | J100 | *Spathiphyllum* | Colombo et al. (1999) |
| *Caliothrips fasciatus* (Pergande, 1895) | A | phyto-phagous | North America | Unknown, GB | GB | J100 | Navel oranges exports (contaminant) | Zur-Strassen (2003) |
| *Chaetanaphothrips orchidii* (Moulton, 1908) | A | phyto-phagous | C & S America | 1935, F | BE, CZ, DE, DK, FI, FR, GB, IL, IT, NO, NL, PT-MAD, SE | J100 | *Anthurium*, banana, *Citrus*, orchids | Bagnall and John (1935), Del Bene and Gargani (2001) |
| *Copidothrips octarticulatus* (Schmutz, 1913) | A | phyto-phagous | Asia-Tropical | 1996, NL | IT, NL | J100 | Araceae, *Piper* | Vierbergen (1996) |
| *Dichromothrips corbetti* (Priesner, 1936) | A | phyto-phagous | Asia-Tropical | Unknown, NL | NL | J100 | Orchidaceae (*Vanda*) | Mantel and van de Vrie (1988) |
| *Dichromothrips phalaenopsidis* Sakimura, 1955 | A | phyto-phagous | Asia-Tropical | 1975, NL | NL | J100 | Orchidaceae | Mound (1976) |
| *Dorcadothrips billeni* Zur-Strassen, 1995 | A | phyto-phagous | Asia-Tropical | 1994, DE | DE | J100 | *Microsorum pteropus* (Oriental water fern) | Zur-Strassen (1995) |
| *Echinothrips americanus* Morgan, 1913 | A | phyto-phagous | North America | 1996, FR | AT, BE, BG, DE, DK, FR, FR-COR, GB, IT, NL, NO, SE, SI | J100 | *Hibiscus* (but polyphagous on ornemental crops) | Reynaud (1998), Vierbergen (1998), Vierbergen et al. (2006), Zur-Strassen (2003) |
| *Frankliniella schultzei* (Trybom, 1910) | C | phyto-phagous | Crypto-genic | 1988, NL | NL | J100 | Polyphagous, recorded as a pest of vegetables and ornemental crops | Vierbergen and Mantel (1991) |
| *Frankliniella fusca* (Hinds, 1902) | A | phyto-phagous | North America | 1964, NL | NL | J100 | Polyphagous, reported to cause direct damage to peanuts and cotton | Mantel and van de Vrie (1988) |

| **Family**<br>*Species* | **Status** | **Regime** | **Native range** | **1st record in Europe** | **Invaded countries** | **Habitat** | **Hosts** | **References** |
|---|---|---|---|---|---|---|---|---|
| *Frankliniella occidentalis* (Pergande, 1895) | A | phyto-phagous | North America | 1983, NL | AL, AT, BE, BG, CH, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IL, IT, IT-SAR, IT-SIC, LT, LV, NL, NO, PT, RO, RS, SE, SK, SI, UA | I2, J100 | Polyphagous (Plants, trees- *Populus*); flowers and leaves; vector tobacco streak ilarvirus (TSV) and tomato spotted wilt virus (TSWV) | Zur-Strassen (1986a), Kirk and Terry (2003) |
| *Heliothrips haemorrhoidalis* (Bouché, 1833) | A | phyto-phagous | C & S America | 1833, DE | AL, AT, BE, BG, CH, CZ, DE, DK, ES, FI, FR, FR- COR, GB, GR, HU, IL, IT, IT-SAR, IT-SIC, LT, LV, MD, MT, NL, NO, PT, PT-AZO, PT-MAD, RO, SE, SI, SK, UA | I2, J100 | Polyphagous (*Citrus*, avocados, ornamental plants) in urban , agricultural and modified habitats, rarely forests, mainly greenhouses | Bouché (1833), Mound et al. (1976), Zur-Strassen (2003), Zur-Strassen and Borges (2005) |
| *Hercinothrips bicinctus* (Bagnall, 1919) | A | phyto-phagous | Tropical, sub-tropical | 1907, BE | BE, DE, DK, ES, ES-CAN, FR, GB, HU, IT, NL, PT-AZO, PT-MAD | J100 | *Musa* spp., passionfruit (folivorous) | Bagnall (1919), Mound et al. (1976), Wilson (1975), Zur-Strassen and Borges (2005) |
| *Hercinothrips femoralis* (Reuter, 1891) | A | phyto-phagous | C & S America | 1891, FI | BE, CZ, DE, DK, ES, ES-CAN, FI, FR, GB, HU, IL, IT, LV, MD, NL, RO, SE, SK, SI, UA | J100 | Polyphagous (banana, beet, celery, *Commelina diffusa*, Crinum, Chrysanthemum, dwarf milo maize, eggplant, *Emilia sonchifolia*, *Erechtites hieracifolia*, grass, orchids, pineapple, *Plantago major*) | Reuter (1891), Mound et al. (1976), Varga (2008) |
| *Leucothrips nigripennis* Reuter, 1904 | A | phyto-phagous | C & S America | 1904, FI | AL, BE, CZ, DE, DK, FI, FR, GB, NL | J100 | Ferns | Reuter (1904), Mound (1999) |

| Family<br>*Species* | Status | Regime | Native range | 1st record in Europe | Invaded countries | Habitat | Hosts | References |
|---|---|---|---|---|---|---|---|---|
| *Microcephalothrips abdominalis* (Crawford, 1910) | A | phyto-phagous | Tropical, sub-tropical | 1999, IT | ES-CAN, HU, IT, SI | I2 | Asteraceae (*Bidens formosa* -cosmos, *Chrysanthemum, Helianthus, Pyrethrum, Tagetes, Zinnia*) | Strapazzon (1999), Vierbergen et al. (2006) |
| *Neohydatothrips samayunkur* (Kudo, 1995) | A | phyto-phagous | Tropical, sub-tropical | 2000, FR | FR | I | Marigold (*Tagetes* sp.) | Reynaud et al. (2001) |
| *Organothrips indicus* Bhatti, 1974 | A | phyto-phagous | Asia | 1985, DE | DE | J100 | Water hyacinth (*Eichhornia crassipes*) in warmed aquarium (aquatic species) | Mound (2000) |
| *Palmiothrips palmae* (Ramakrishna, 1934) | A | phyto-phagous | Asia-Tropical | 1965, ES-CAN | ES-CAN, IL | I2 | *Phoenix* flowers, including date palm, *Phoenix dactilifera* | Zur-Strassen (1965) |
| *Parthenothrips dracaenae* (Heeger, 1854) | A | phyto-phagous | Africa | 1852, AT | AT, BE, BG, CH, CZ, DE, DK, ES, FI, FR, GB, GR, HU, IS, IT, LV, MD, NL, NO, RO, SE, SI | J100 | *Dracena, Ficus* | Heeger (1854), Trdan et al. (2005) |
| *Pezothrips kellyanus* (Bagnall, 1916) | C | phyto-phagous | Crypto-genic | 1981, GR | ES, FR, GR, IT-SIC, IL, NL | I2 | *Citrus* | Zur-Strassen (1986b), Zur-Strassen (2003) |
| *Phibalothrips peringueyi* (Faure, 1925) | A | phyto-phagous | Tropical, sub-tropical | 1985, IT-SIC | IT, IT-SIC | E | Grasses | Zur-Strassen (1996), Zur-Strassen (2003) |
| *Plesiothrips perplexus* (Beach, 1896) | A | phyto-phagous | C & S America | 1975, PT-MAD | IT, PT-AZO, PT-MAD | E | Poaceae | Zur-Strassen (1982), Zur-Strassen and Borges (2005) |
| *Pseudodendrothrips mori* (Niwa, 1908) | A | phyto-phagous | Asia-Tropical | 1974, IT | ES, FR, IT, SI | I2 | *Morus* | Cappellozza and Miotto (1975), Vierbergen et al. (2006) |

| **Family**<br>*Species* | **Status** | **Regime** | **Native range** | **1st record in Europe** | **Invaded countries** | **Habitat** | **Hosts** | **References** |
|---|---|---|---|---|---|---|---|---|
| *Psydrothrips kewi* Palmer & Mound, 1985 | A | phyto-phagous | C & S America | 1982, GB | GB | J100 | *Philodendron* | Palmer and Mound (1985) |
| *Pteridothrips pteridicola* (Karny, 1914) | A | phyto-phagous | Asia-Tropical | 1995, DE | DE, SE | J100 | *Microsorum pteropus* (Oriental water fern) | Billen and Zur-Strassen (1995) |
| *Scirtothrips longipennis* (Bagnall, 1909) | C | phyto-phagous | Crypto-genic | 1909, BE | BE, CZ, DE, DK, FI, FR, IT, LV, NO, NL, PT-MAD, SE | J100 | Avocado, onions, … | Bagnall (1909), Hoddle and Mound (2003) |
| *Stenchaetothrips biformis* (Bagnall, 1913) | A | phyto-phagous | Asia-Tropical | 1913, GB | CZ, GB, IT, NL, PL, RO | J100 | Growing tips of seedling rice, *Oryza sativa* (larva, adult); secondary hosts: maize, *Zea mays*, wild sugarcane, *Saccharum spontaneum*, wild grasses (*Agropyron*- wheatgrass, *Festuca*-fescues, *Pennisetta*) | Bagnall (1913), Kucharczyk and Zawirska (2001), Vierbergen (2004) |
| *Stenchaetothrips spinalis* Reyes, 1994 | A | phyto-phagous | Asia-Temperate | 1999, FR | FR | I2 | Bambusoideae | Streito and Martinez (2005) |
| *Thrips australis* (Bagnall, 1915) | A | phyto-phagous | Australasia | 1930, CY | CY, ES, ES-CAN, FR, GR, IT, IT-SIC, PT, PT-AZO, PT-MAD | I2, F6 | *Eucalyptus, Melaleuca* | Priesner (1964a), Priesner (1964b), Zur-Strassen (1973b), Zur-Strassen and Borges (2005) |
| *Thrips palmi* Karny, 1925 | A | phyto-phagous | Asia-Tropical | 1995, PT | CZ, NO, PT | I, J | Quarantine pest, polyphagous but a threat to glasshouse ornamental and vegetable crops in Europe | Anonymous (2004), Cannon et al. (2007) |
| *Thrips simplex* Morrison, 1930 | A | phyto-phagous | Africa | 1946, FR | AT, BG, CH, CZ, DE, ES, ES-CAN, FR, GB, HU, IL, IT, NO, NL, PT, PT-AZO, RO, SE, SI, UA | I2, J100 | *Gladiolus*, polyphagous in greenhouses | Aitkenhead (1951), Bournier (1954), Zur-Strassen and Borges (2005), Milevoj et al. (2008) |

**Table 13.1.2.** List and main characteristics of some Thysanoptera species alien *in* Europe. Country codes abbreviations refer to ISO 3166 (see appendix I). Habitat abbreviations refer to EUNIS (see appendix II). Only selected references are given. Last update 03/02/2010

| **Family**<br>Species | **Regime** | **Native range** | **Invaded countries** | **Habitat** | **Hosts** | **References** |
|---|---|---|---|---|---|---|
| **Aeolothripidae** | | | | | | |
| *Aeolothrips fasciatus* (L., 1758) | predator/ phytophagous | Europe | PT- AZO | E, I | Both a pollen feeder and a predator of onion thrips; *Taraxacum officinale*, *Trifolium repens*, *Epilobium angustifolium*, Grasses | Zur-Strassen and Borges (2005) |
| *Rhipidothrips gratiosus* Uzel, 1895 | phytophagous | Europe | GB | I,J | Grasses, wild oats | Mound et al. (1976) |
| **Phlaeothripidae** | | | | | | |
| *Apterygothrips pinicolus* Pelikan & Schliephake, 1994 | phytophagous | Europe | DE, CZ | G3 | *Pinus* | Pelikán and Schliephake (1994) |
| *Hoplandrothrips consobrinus* (Knechtel, 1951) | mycophagous | Europe | ES- CAN, PT- AZO | U | Dead wood or leaf-litter | Zur-Strassen and Borges (2005) |
| *Hoplothrips ulmi* (F., 1781) | mycophagous | Europe | PT- AZO | G | Dead wood of broadleaved trees, feeding on fungi (possibly *Peniophora*) | Zur-Strassen and Borges (2005) |
| *Liothrips vaneeckei* Priesner, 1920 | phytophagous | Europe | GB | J100 | Lilly bulbs | Bagnall (1933), Mound et al. (1976) |
| **Thripidae** | | | | | | |
| *Aptinothrips rufus* Haliday, 1836 | phytophagous | Europe | PT- AZO | I | Grasses, cereals | Zur-Strassen and Borges (2005) |
| *Chirothrips manicatus* Haliday, 1836 | phytophagous | Europe | PT- AZO | I | *Alopecurus pratensis*, *Lilium*, clover, peach, pear, apple, grasses, wheat | Zur-Strassen and Borges (2005) |
| *Euphysothrips minozzii* Bagnall, 1926 | mycophagous | Europe | AT | U | Fungi infecting weeds | Zur-Strassen (2003) |
| *Limothrips cerealium* Haliday, 1836 | phytophagous | Europe | PT- AZO | E, I, J | Poaceae | Zur-Strassen and Borges (2005) |
| *Odontothrips meliloti* Priesner, 1951 | phytophagous | Europe | GB | G3, G4 | *Melilotus* | Pitkin (1972), Mound et al. (1976) |
| *Thrips tabaci* Lindeman, 1889 | phytophagous | Europe | GB | I1, I2, FA, E2, E5 | Polyphagous (weeds, flowers, trees and crops) | Bagnall (1923) |